UNI-4 for imc CRONOSflex (CRFX/UNI-4)

4-channel, high-performance universal measurement amplifier

The UNI-4 is the most universal measurement amplifier in the portfolio. With 4 differential analog inputs, it is capable of measuring:

- Voltage and current (isolated measurement)
- Temperature (thermocouple, isolated measurements)
- PT100, PT1000
- Bridge and strain gauge (quarter-, half- and full-bridge)
- IEPE/ICP sensors (via the optional DSUB plugs)

Channel-wise, independently configurable supply voltages (non-isolated) between 0.25 V to 24 V are available for supplying external sensors or bridge measurements.

The channels are individually, galvanically isolated for voltage, current and thermocouple measurements. Each channel is equipped with its own simultaneous A/D converter and adjustable filter (e.g., anti-aliasing filter).

CRFX/UNI-4

Highlights

- Individual, galvanically isolated measurement of voltage, current and thermocouples
- Channel-wise, individually configurable sensor and bridge supply
- PT100 and PT1000 supported
- High signal bandwidth of up to 48 kHz
- Internal quarter-bridge completion of 120, 350 and 1 kΩ
- Double or single sense wire schemes supported with bridge supply
- Broken wire sensor error detection
- Integrated shunt calibration for bridge mode
- Supports imc Plug& Measure(Transducer Electronic Data Sheets)

Typical applications

- Provides maximum flexibility for changing measurement and sensor requirements, including channel-wise, individual sensor supplies.

imc CRONOS*flex* - Frameless expansion, flexible modularity

The imc Click Mechanism and extruded aluminum case provide a firm mechanical and electrical connection. As a result, no mainframe or rack is needed.


imc Click Mechanism

An imc CRONOS*flex* system uses EtherCAT as an "internal" system bus for connecting various modules to the main base unit (CRFX-400 / CRFX-2000G). With the system bus, all imc CRONOS*flex* modules are guaranteed to be synchronized with each other. This allows various modules to be either connected in one central block or connected via standard network cable in a spatially distributed system.

Alternatively, connection can be made by means of standard Ethernet cables (RJ45, CAT5), thus creating a spatially distributed system.

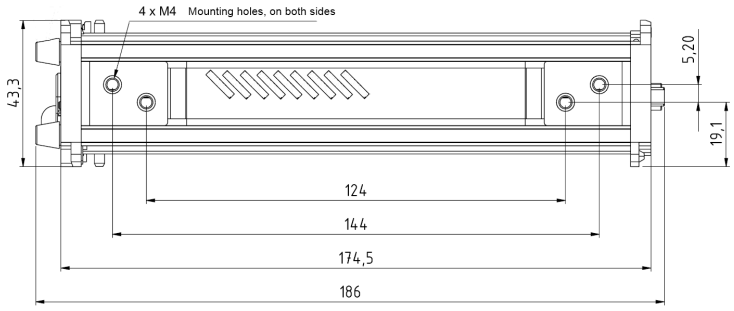

CRFX distributed system

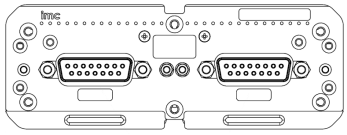
Overview of available variants

Standard version		ET-version *	
Order Code:	article no.	article no.	remarks
CRFX/UNI-4	11900063	11910039	with DSUB-15 sockets
CRFX/UNI-4-L	11900064	11910040	with LEMO sockets

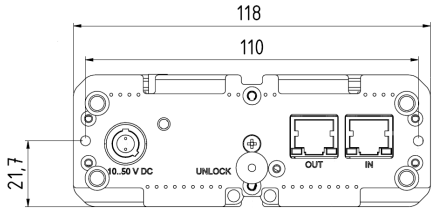
* ET: Version for an extended temperature range

Mechanical drawings with dimensions





front view



rear view

Module power supply options

- Direct connection (LEMO.EGE.1B.302 power socket)
- Adjacent module (module connector / imc Click Mechanism)
- EtherCAT network cable: Power over EtherCAT (PoEC)

For further details refer to the power options documentation.

Included accessories

DSUB-15 plug		
ACC/DSUBM-UNI2	DSUB-15 plug with screw terminals for 2-channel voltage, and bridge measurement as well as temperatures with PT100 and thermocouples with integrated cold junction compensation (CJC)	13500169

Documents
Getting started with imc CRONOS*flex* (one copy per delivery)
Device certificate

Optional accessories

DSUB-15 plug		
ACC/DSUBM-TEDS-UNI2	version with TEDS support, according to IEEE 1451.4 for use with imc Plug & Measure	13500188
ACC/DSUBM-I2	DSUB-15 plug with screw terminals for 2-channel current measurement of up to 50 mA (50 Ω shunt, scaling factor: 0.02A/V)	13500180
ACC/DSUBM-TEDS-I2	version with TEDS support, according to IEEE 1451.4 for use with imc Plug & Measure	13500193
ACC/DSUBM-ICP2I-BNC-S	DSUB-15 plug for 2 IEPE/ICP sensors, BNC connection, isolated, **slow**	13500293

DSUB-15 plug		
ACC/DSUBM-ICP2I-BNC-F	DSUB-15 plug for 2 IEPE/ICP sensors, BNC connection, isolated, **fast**	13500294

AC/DC power adaptor 110-230 VAC 50-60 Hz (with appropriate LEMO.1B.302 plug)		article no.
48 V DC / 150 W	ACC/AC-ADAP-48-150-1B	13500148
24 V DC / 60 W	CRPL/AC-ADAPTER-60W-1B	10800066

Power plugs		
ACC/POWER-PLUG-5	Power plug for DC supply LEMO.FGE.1B.302 plug (male, E-coded: 2 coding keys)	13500150
CRFX/MODUL-PP-90	Power plug for DC supply 90° angular LEMO.FHE.1B.302 plug (male, E-coded: 2 coding keys)	11900074

Supply module (Power Handle)		article no.
CRFX/HANDLE-POWER-L	Handle with system power supply 50 V 100 W, without UPS	11900058
CRFX/HANDLE-NIMH-L	Handle with system power supply 50 V 100 W, UPS with NiMH battery	11900273
CRFX/HANDLE-LI-IO-L	Handle with system power supply 50 V 100 W, UPS with Li-Ion battery	11900010

Passive-Handle		
CRFX/HANDLE-L	standard unpowered left handle	11900008
CRFX/HANDLE-R	standard unpowered right handle	11900007

Mounting bracket for increased stability (recommended for lifetime and robustness)		
CRFX/BRACKET-CON	assembly element for 2 modules	11900071

Mounting brackets for fixed installations		
CRFX/BRACKET-90	mounting bracket 90°	11900068
CRFX/BRACKET-180	mounting bracket 180°	11900069
CRFX/BRACKET-BACK	rear panel mounting element	11900070
CRFX/RACK	19" RACK for imc CRONOS*flex* Modules	11900066
CRFX/BRACKET-RACK	mounting element in the RACK	11900072

Documents		
SERV/CAL-PROT	Calibration protocol per amplifier imc manufacturer calibration certificate with measurement values and list of calibration equipment used (pdf).	150000566
SERV/CAL-PROT-PAPER	Calibration protocol per amplifier (paper print) imc manufacturer calibration certificate with measurement values and list of calibration equipment used with signature and seal.	150000578
Device certificates and calibration protocols: Detailed information on certificates supplied, the specific contents, underlying standards (e.g. ISO 9001 / ISO 17025) and available media (pdf etc.) can be found on our website, or you can contact us directly.		

Technical Specs - CRFX/UNI-4

Inputs, measurement modes, terminal connection		
Parameter	**Value**	**Remarks**
Inputs	4	
Measurement modes DSUB		ACC/DSUBM-UNI2 for all modes
isolated measurement modes:	voltage measurement (differential) current measurement thermocouple measurement	 with Shunt-plug (ACC/DSUBM-I2)
non-isolated measurement modes:	voltage measurement (single-end) current measurement bridge-sensor strain gauges PT100/PT1000 (3- and 4-wire connection) current fed sensors (IEPE/ICP)	 with internal Shunt with DSUB-15 extension plug ACC/DSUBM-ICP2I-BNC-S/-F, isolated
Measurement modes LEMO		
isolated measurement modes:	voltage measurement (differential) thermocouple measurement	 with ACC/TH-LEM-150
non-isolated measurement modes:	voltage measurement (single-end) current measurement bridge-sensor strain gauges PT100/PT1000 (3- and 4-wire connection)	 with internal shunt
Terminal connections Standard LEMO	 2x DSUB-15 4x LEMO.1B.307	 2 channels per plug 1 channel per plug

Individual Sensor- and Bridge supply		
Parameter	**Value**	**Remarks**
Output-Voltage	channel-wise individually configurable 15 V, 12 V, 10 V, 5 V, 2,5 V	 5 possible settings standard version
	5 settings configurable out of: 24 V, 15 V, 12 V, 10 V, 5 V, 2.5 V, 1 V, 0.5 V, 0.25 V	special version, special order
Short circuit protection	unlimited duration	
Output power	0.5 W / channel 0.2 W / channel	≥5 V ≤2.5 V
Accuracy	±0.2%	At the amplifier terminals, no load. Does not affect the accuracy in bridge mode (live software compensation of actual value and of additional cable loss via SENSE)

Sampling rate, Bandwidth, Filter, TEDS		
Parameter	**Value**	**Remarks**
Sampling rate	≤100 kHz	per channel
Bandwidth	0 Hz to 48 kHz 0 Hz to 46 kHz	-3 dB 0.2 dB
Filter cut-off frequency characteristic order	10 Hz to 20 kHz	Butterworth, Bessel low pass or high pass filter: 8th order band pass: LP 4th and HP 4th order Anti-aliasing filter: Cauer 8.order with $f_{cutoff} = 0.4\ f_s$
Resolution	16 Bit 24 Bit	output format is selectable for each channel individually: a) 16 Bit Integer b) 32 Bit Float (24 Bit Mantissa)
TEDS - Transducer Electronic DataSheets	conforming to IEEE 1451.4 Class II MMI	esp. with ACC/DSUBM-TEDS-xx (DS2433) not supported DS2431 (typ. IEPE/ICP sensor)
Characteristic curve linearization	user defined (max. 1023 supporting points)	

General		
Parameter	**Value**	**Remarks**
Isolation of voltage channels	channel-wise galvanically-isolated	voltage channels isolated against each other and against system ground (housing, CHASSIS), as well as against common reference and all bridge excitation voltages "-VB" Isolation with IEPE/ICP plug: depends on plug type
Bridge excitation voltage isolation	not channel-wise isolated	isolated against additional electronics (all sensor power supplies, bridge and input wiring, TEDS, etc.) with common reference ground "-VB" Block-isolated against system ground (housing, CHASSIS)
Max common mode voltage isolated mode tested:	±60 V 300 V (10 s)	against internal reference ground "-VB", against system ground (housing, CHASSIS)
Max common mode voltage non-isolated mode	±10 V	against internal reference ground "-VB" Also for "non-isolated" mode, there is an additional global block-isolation of the entire internal measurement electronics from the housing (CHASSIS)

General			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Overvoltage protection (inputs +IN, -IN)	±100 V ESD 2 kV transient protection: automotive load dump ISO 7636		differential input voltage (continuous) human body model R_i=30 Ω, t_d=300 µs, t_r<60 µs
Input coupling	DC		
Input impedance	10 MΩ 1 MΩ		voltage mode (range ≤±2 V), temperature mode voltage mode (range ≥±5 V)
Input current operating conditions on overvoltage condition	1 mA	2.4 nA	$\|V_{in}\|$ >5 V on ranges <±2 V
Input noise	2.2 μV_{rms} / 15 μV_{pkpk} 0.3 μV_{rms} / 2.1 μV_{pkpk} 0.1 μV_{pkpk} 10 nV / √Hz		range ≤±25 mV bandwidth 0.1 to 48 kHz bandwidth 0.1 to 1 kHz bandwidth 0.1 to 10 Hz spectral noise density (at 1 kHz)
CMRR (common mode rejection ratio) / IMR	>145 dB (50 Hz) >80 dB (50 Hz)		range ≤±2 V range ≥±5 V R_{source} = 0 Ω
Spurious free dynamic range (SFDR)	>80 dB (10 kHz) >95 dB (1 kHz) >84 dB (10 kHz) >100 dB (1 kHz)		range ≤±2 V range ≥±5 V
Auxiliary supply voltage available current internal resistance	+5 V 0.26 A 1.0 Ω	±5% 0.2 A <1.2 Ω	for IEPE/ICP-extension plug independent of integrated sensor supply, short-circuit protected power per DSUB-plug

Voltage measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Voltage input range	±60 V, ±50 V, ±25 V, ±10 V, ±5 V, ±2 V, ±1 V, ±500 mV, ±250 mV, ±100 mV, ±50 mV, ±25 mV, ±10 mV, ±5 mV, ±2.5 mV		with single-end mode: max. ±10 V
Input configuration	differential / single-end		
Gain error	<0.02%	<0.05%	of the measured value, at 25°C
Gain drift		20 ppm/K·ΔT_a 60 ppm/K·ΔT_a	range ≤±2 V range ≥±5 V ΔT_a= |T_a-25°C|; with T_a = ambient temperature
Offset error		 0.01% 10 µV	of the range range ≥±50 mV range ≤±25 mV
Offset drift	0.7 µV/K·ΔT_a		range ≤±25 mV ΔT_a= |T_a-25°C|; with T_a = ambient temperature

Current measurement with Shunt-Plug			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Current input range	±40 mA, ±20 mA, ±10 mA		
Shunt-Resistor	50 Ω		external plug ACC/DSUBM-I2
Input configuration	differential		isolated
Gain error	<0.02%	<0.05% <0.1%	of the measured value, at 25°C additional error of 50 Ω in plug
Gain drift	10 ppm/K·ΔT_a	30 ppm/K·ΔT_a	ΔT_a= |T_a-25°C|; with T_a = ambient temperature
Offset error		<0.01%	of the range, at 25°C

Current measurement with internal shunt			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Current input range	±50 mA, ±20 mA, ±10 mA, ±5 mA, ±2 mA, ±1 mA		
Shunt-Resistor	120 Ω		internal
Input configuration	single-end		not isolated
Gain error	<0.02%	<0.05%	of the measured value, at 25°C
Gain drift	10 ppm/K·ΔT_a	30 ppm/K·ΔT_a	ΔT_a= |T_a-25°C|; with T_a = ambient temperature
Offset error		<0.01%	of the range, at 25°C

Bridge measurement			
Parameter	**Value typ.**	**min. / max.**	**Remarks**
Mode	DC		
Measurement modes	full, half, quarter bridge		
Measurement range			
bridge supply: 10 V	±1000 mV/V, ±500 mV/V, ±200 mV/V, ±100 mV/V, ±50 mV/V, ±25 mV/V, ... ±0.5 mV/V, ±0.25 mV/V		
bridge supply: 5 V	±1000 mV/V, ±400 mV/V, ±200 mV/V, ±100 mV/V, ±50 mV/V ... ±1 mV/V, ±0.5 mV/V		
bridge supply: 2.5 V	±800 mV/V, ±400 mV/V, ±200 mV/V, ±100 mV/V, ... ±2 mV/V, ±1 mV/V		
(bridge supply: 1 V)	±1000 mV/V, ... , ±2.5 mV/V		special order
(bridge supply: 0.5 V)	±1000 mV/V, ... , ±5 mV/V		special order
(bridge supply: 0.25 V)	±800 mV/V, ... , ±10 mV/V		special order
Bridge supply	0.25 V to 10 V		selectable for each channel possible options: see above
Minimum bridge impedance	200 Ω 50 Ω 32 Ω		bridge supply = 10 V bridge supply = 5 V bridge supply = 2.5 V
Cable-Compensation			
full bridge / half bridge	4-wire-technique 3-wire-technique with shunt-calibration		any cable for symmetric (similar) cables one-time non-adaptive compensation
quarter bridge	full compensation in 3-wire-technique		including Gain-Correction!
Quarter bridge completion	120 Ω, 350 Ω, 1 kΩ		switched per software / bridge supply ≤5 V
Automatic shunt-calibration (calibration step)	0.5 mV/V		with 120 Ω and 350 Ω
Input impedance	6.7 MΩ	±1%	differential, full bridge
Gain error	<0.02%	<0.05%	of the reading, at 25°C
Gain drift		20 ppm/K·ΔT_a	$\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature
Offset error	within residual noise band		
Offset drift		0.14 µV/V /K·ΔT_a	$\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature
Drift half bridge	0.5 µV/V / °C	1 µV/V / °C	additional drift of internal half bridge completion
Bridge offset balancing range	≥100% of measurement range ≥±4 mV / V		valid for the entire meas. range
Cable resistance	<60 Ω		120 Ω bridge
max cable length (simple)	<460 m		0.14 mm², 130 mΩ / m

Temperature measurement			
Thermocouple	**Value typ.**	**min. / max.**	**Remarks**
Measurement mode	J, T, K, E, N, S, R, B		
Measurement range	-270°C to 1370°C -270°C to 1100°C -270°C to 500°C		type K
Resolution	0.063 K (1/16 K) 32 bit float (24 Bit mantissa)		With selected data type / output format: a) 16-Bit integer b) Float (24-Bit mode)
Measurement error (gain + offset)		<±0.6 K <±1.0 K	with type K range -150°C to 1100°C else
Drift (gain + offset)		±0.02 K/K·ΔT_a ±0.05 K/K·ΔT_a	type K, range -270°C to 1100°C type K, range -270°C to 1370°C $\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature
Error of cold junction compensation		<±0.15 K	with ACC/DSUBM-UNI2
Cold junction drift	±0.001 K/K·ΔT_a		$\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature

Temperature measurement			
PT100 / PT1000	**Value typ.**	**min. / max.**	**Remarks**
Measurement range	-200°C to 850°C -200°C to 250°C		
Resolution	0.063 K (1/16 K) 32 bit float (24 Bit mantissa)		With selected data type / output format: a) 16-Bit integer b) Float (24-Bit mode)
Measurement error		<±0.05%	of the measured value
Offset error		<±0.1 K	4-wire connection
Offset drift		+0.01 K/K·ΔT_a	$\Delta T_a = \lvert T_a - 25°C \rvert$; with T_a = ambient temperature
Sensor feed	250 µA		

Block isolation		
Parameter	**Value**	**Remarks**
Block isolation	60 V	all internal electronics isolated from the housing (CHASSIS, PE) Exception: additional individual isolated voltage channels
Isolation impedance	500 kΩ || 1 nF	
Internal reference ground	-VB, GND, TEDS_GND	all channels with one common, galvanically connected reference ground
External reference ground	CHASSIS, metal housing	internal electronics as an entity, galvanically isolated from housing

Block isolation for improved suppression of ground loops and related interference. Does not constitute channel-wise individual isolation. Not rated nor intended for safety of equipment and personnel.

Power supply		
Parameter	**Value**	**Remarks**
Input supply voltage	10 V to 50 V DC	
Power consumption	10 W	10 V to 50 V DC
Isolation	60 V	nominal isolation specification of the supply input
Power-over EtherCAT (PoEC)	42 V to 50 V DC	supply via EtherCAT network cable

Terminal connections of the module		
Parameter	**Value**	**Remarks**
EtherCAT connection	2x RJ45	system bus for distributed imc CRONOS*flex* components
Input supply plug (female)	LEMO.EGE.1B.302	multicoded 2 notches for optional individually power supply
Module connector	2x 20 pin	direct connection of modules (click) supply and system bus

Pass through power limits	
Directly connected (clicked) imc CRONOS*flex* Modules	3.1 A (maximum current) Equivalent power with chosen DC power input: • 149 W @ 48 V DC (e.g. AC/DC line adaptor) • 37 W @ 12 V DC (typical vehicle supplied DC input)
Power-over EtherCAT (PoEC) for remote imc CRONOS*flex* Modules	350 mA (maximum current, corresponding to IEEE 802.3) Equivalent power with chosen DC power input: • 17.5 W @ 50 V DC (e.g. Power Handle) • 16.8 W @ 48 V DC (e.g. AC/DC line adaptor) • 14.7 W @ 42 V DC (minimum voltage for PoEC) Note: minimum system power of 42 V DC required for PoEC

Operating conditions		
Parameter	**Value**	**Remarks**
Operating environment	dry, non corrosive environment within specified operating temperature range	
Rel. humidity	80% up to 31°C, above 31°C: linear declining to50%	according IEC 61010-1
Ingress protection rating	IP20	
Pollution degree	2	
Operating temperature (standard)	-10°C to +55°C	without condensation
Operating temperature (extended: "-ET" version)	-40°C to +85°C	condensation temporarily allowed
Shock- and vibration resistance	IEC 61373, IEC 60068-2-27 IEC 60062-2-64 category 1, class A and B MIL-STD-810 Rail Cargo Vibration Exposure U.S. Highway Truck Vibration Exposure	
Extended shock- and vibration resistance	upon request	specific tests or certifications upon request
Dimensions	43.3 x 118 x 186 mm	W x H x D
Weight	850 g	